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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/780,826	02/17/2004	Anand Murthy	ITL.1064US (P18031)	3751
21906	7590	03/03/2006	EXAMINER	
TROP PRUNER & HU, PC 8554 KATY FREEWAY SUITE 100 HOUSTON, TX 77024			BLUM, DAVID S	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 03/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/780,826

Applicant(s)

MURTHY ET AL.

Examiner

David S. Blum

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 20 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 14-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 19-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 1-32 are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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This is in response to the election filed 10/20/05.

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election without traverse of claims 1-13 and 19-32 in the paper filed 10/20/06 is acknowledged.
2. Claims 14-28 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the paper filed 10/20/05.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claim 13 recites the limitation "over said removed source/drain regions" in claim 1. There is insufficient antecedent basis for this limitation in the claim.

### ***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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6. Claims 1-5 and 11-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Steele (US 5,498,578).

Steele teaches all of the positive steps of claims 1-5 and 11-12 as follows.

Regarding claim 1, Steele deposits a mobility enhancing silicon material (column 2 lines 30-34 and column 4 lines 23-25; The instant specification defines a mobility enhancing silicon material as a carbon doped silicon or silicon-germanium material. This is the material deposited by Steel) Steele also deposits silicon oxide (57; an amorphous material) and selectively removes the oxide without substantially removing the carbon doped layer (figures 8 and 9).

Regarding claim 2, the material enhances compressive strain (column 4 lines 52-55; The instant specification defines a material that enhances compressive strain as a carbon doped silicon-germanium material. This is a material deposited by Steel).

Regarding claim 3, the material enhances tensile strain (column 4 lines 30-34 and column 4 lines 23-25, The instant specification defines a material that enhances compressive strain as a carbon doped silicon material. This is a material deposited by Steel).

Regarding claim 4, the material may be carbon doped (column 2 lines 30-34 and column 4 line 54).

Regarding claim 5, the material may be boron doped silicon (column 4 line 50).

Regarding claim 11, a strained NMOS transistor (column 6 line 29) is formed. Although Steele does not use the word "strained", the instant specification teaches that it is the carbon doped silicon that creates the strain. As the layer of Steele is carbon doped silicon, the NMOS is strained.

Regarding claim 12, a strained PMOS transistor (column 6 line 30) is formed. Although Steele does not use the word "strained", the instant specification teaches that it is the carbon doped silicon that creates the strain. As the layer of Steele is carbon doped silicon, the PMOS is strained.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steele (US 5,498,578) in view of Hembree (US 6,224,713).

Steele teaches all of the positive steps of claims 6-8 as recited above in regard to claim 1, except for limitations of etching in the presence of sonication.

Regarding claim 6, Steele teaches removing the material by etching. Hembree teaches etching using sonication (ultrasonic waves) as during the etching of polysilicon (column 4 lines 17-23). Hembree teaches that sonication results in a substantially defect free structure at the submicron level and reduces hydrogen bubble adhesion (abstract).

Regarding claim 7, Hembree teaches etching silicon with sonication using tetraethylammonium (TMAH, column 4 line 33).

Regarding claim 8, Hembree teaches etching silicon with sonication using an ammonium hydroxide (NH<sub>4</sub>OH column 4 line 33).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Steele by etching with sonication as taught by Hembree to result in a substantially defect free structure at the submicron level and reduces hydrogen bubble adhesion (abstract).

9. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Steele (US 5,498,578) in view of the admitted prior art (page 1).

Steele teaches all of the positive steps of claim 6 as recited above in regard to claim 1, except for removing the source and drain prior to forming the blanket layer.

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Regarding claim 13, the admitted prior art (page 1) teaches that it is known prior art to form strained channel epitaxial source/drain transistors and that in forming such a transistor, it is admitted prior art to remove the implanted source/drain and then implant a germanium doped silicon material into the source and drains.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Steele by removing the source/drain prior to implanting a germanium doped silicon material into the source and drains as described in the admitted prior art (page 1) as a known practice to form strained channel transistors and thus increase electron mobility

10. Claims 19-21 and 26-28 and 31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art (page 1) in view of Steele (US 5,498,578).

The admitted prior art teaches all of the positive steps of claims 19-20 except for forming an amorphous film over the gate structures.

Regarding claim 19, the admitted prior art (page 1) teaches that it is known prior art to form strained channel epitaxial source/drain transistors and that in forming such a transistor, it is admitted prior art to remove the implanted source/drain and then implant a germanium doped silicon material into the source and drains. Steele teaches forming an amorphous material over the silicon doped material (and over the gates) as a passivation layer (column 7 line 28).

Regarding claim 20, the deposition of material includes a carbon doped silicon material (column 2 lines 30-34 and column 4 lines 53-55).

Regarding claim 21, Steele deposits silicon oxide (57; an amorphous material) and selectively removes the oxide without substantially removing the carbon doped layer (figures 8 and 9).

Regarding claim 26, the admitted prior art (page 1) teaches that it is known prior art to form strained channel epitaxial source/drain transistors and that in forming such a transistor, it is admitted prior art to remove the implanted source/drain and then implant a germanium doped silicon material into the source and drains. Steele teaches forming an amorphous material over the silicon doped material (and over the gates) as a passivation layer (column 7 line 28). Steele deposits a mobility enhancing silicon material (column 2 lines 30-34 and column 4 lines 23-25; The instant specification defines a mobility enhancing silicon material as a carbon doped silicon or silicon-germanium material. This is the material deposited by Steel) Steele also deposits silicon oxide (57; an amorphous material) and selectively removes the oxide without substantially removing the carbon doped layer (figures 8 and 9).



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Regarding claim 27, the material enhances compressive strain (column 4 lines 52-55;

The instant specification defines a material that enhances compressive strain as a carbon doped silicon-germanium material. This is a material deposited by Steel).

Regarding claim 28, the material enhances tensile strain (column 4 lines 30-34 and column 4 lines 23-25, The instant specification defines a material that enhances compressive strain as a carbon doped silicon material. This is a material deposited by Steel).

Regarding claim 31, the admitted prior art (page 1) teaches that it is known prior art to form strained channel epitaxial source/drain transistors and that in forming such a transistor, it is admitted prior art to remove the implanted source/drain.

Regarding claim 32, Steele teaches forming an amorphous material over the silicon doped material (and over the gates) as a passivation layer (column 7 line 28). Steele deposits a mobility enhancing silicon material (column 2 lines 30-34 and column 4 lines 23-25; The instant specification defines a mobility enhancing silicon material as a carbon doped silicon or silicon-germanium material. This is the material deposited by Steel).

It would be obvious to one skilled in the requisite art at the time of the invention to modify the admitted prior art by forming an amorphous material over the silicon doped

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material (and over the gates) as a passivation layer as taught by Steele (column 7 line 28).

11. Claims 22-24 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art (page 1) in view of Steele (US 5,498,578) and in further view of Hembree (US 6,224,713).

The admitted prior art teaches all of the positive steps of claims 22-24 and 29 as recited above in regard towards claims 21 and 26, except for etching in the presence of sonication (ultrasound).

Regarding claims 22 Steele teaches removing the material by etching. Hembree teaches that sonication results in a substantially defect free structure at the submicron level and reduces hydrogen bubble adhesion (abstract).

Regarding claim 23, Hembree teaches etching silicon with sonication using tetraethylammonium (TMAH, column 4 line 33).

Regarding claim 24, Hembree teaches etching silicon with sonication using a ammonium hydroxide (NH<sub>4</sub>OH column 4 line 33).

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Regarding claims 29 Steele teaches removing the material by etching. Hembree teaches that sonication results in a substantially defect free structure at the submicron level and reduces hydrogen bubble adhesion (abstract).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Steele by etching with sonication as taught by Hembree to result in a substantially defect free structure at the submicron level and reduces hydrogen bubble adhesion (abstract).

12. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steele (US 5,498,578) in view of Wolf (pages 142, 169, and 179).

Steele teaches all of the positive steps of claims 9-10 as recited above in regard to claim 1, except for limitations of depositing using trisilane.

Regarding claim 9, Steele deposits using silane (column 4 line 32). Wolf teaches silane and trisilane are both sources of silicon for CVD deposition of silicon (page 142), giving the two an art recognized equivalence.

Regarding claim 10, Wolf teaches depositing amorphous silicon at 550 degrees C. (page 169). The difference between 550 and below 550 is considered one of optimization.

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These ranges are considered to involve routine optimization while it has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* (105 USPQ233), the selection of reaction parameters such as temperature and concentration would have been obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art. Such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

*In re Aller* 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

One skilled in the requisite art at the time of the invention would have used any ranges or exact figures suitable to the method in the process of depositing material regarding temperature using prior knowledge, experimentation, and observation with the apparatus used in order to optimize the process and produce the amorphous layer structure desired to the parameters desired.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Steel by using trisilane as the silicon source for silicon deposition as taught by Wolf to be an art recognized equivalent to silane.

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13. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art (page 1) in view of Steele (US 5,498,578) and in further view of Wolf (pages 142 and 169).

The admitted prior art and Steele teach all of the positive steps of claim 25 as recited above in regard to claim 19, except for limitations of depositing using trisilane.

Regarding claim 25, Steele deposits using silane (column 4 line 32). Wolf teaches silane and trisilane are both sources of silicon for CVD deposition of silicon (page 142), giving the two an art recognized equivalence. Further, Wolf teaches depositing amorphous silicon at 550 degrees C. (page 169). The difference between 550 and below 550 is considered one of optimization as recited above (see regarding claim 10).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Steel by using trisilane as the silicon source for silicon deposition as taught by Wolf to be an art recognized equivalent to silane.

14. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art (page 1) in view of Steele (US 5,498,578) and Hembree (US 6,224,713) and in further view of Wolf (pages 142 and 169).

The admitted prior art and Steele teach all of the positive steps of claim 30 as recited above in regard to claim 29, except for limitations of depositing using trisilane.

Regarding claim 30, Steele deposits using silane (column 4 line 32). Wolf teaches silane and trisilane are both sources of silicon for CVD deposition of silicon (page 142), giving the two an art recognized equivalence. Further, Wolf teaches depositing amorphous silicon at 550 degrees C. (page 169). The difference between 550 and below 550 is considered one of optimization as recited above (see regarding claim 10).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Steel by using trisilane as the silicon source for silicon deposition as taught by Wolf to be an art recognized equivalent to silane.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (571)-272-1687) and e-mail address is [David.blum@USPTO.gov](mailto:David.blum@USPTO.gov) .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (571) 273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read "D. S. Blum", with a horizontal line extending to the right.

David S. Blum

February 28, 2006